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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Method and apparatus for glass flakes.**

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Description

Field of the Invention

The invention relates to a method and apparatus for forming flakes of glass or flakes of other like material.

The method and apparatus are applicable equally to any material which would melt when heated capable of being formed into flakes. Flakes of glass and similar materials are increasingly being used for the reinforcement of plastics or other composite materials.

One method which has been employed in the past to form flakes of glass has involved forming a thin walled cylinder of molten glass and then collapsing the cylinder to fracture the glass film to form glass flakes. The glass flakes produced by such a method are not flat or planar which is undesirable for many purposes.

A method and apparatus for forming flakes of glass was disclosed in UK Patent Specification No 989671. This method is one in which the stream of heat softened material is fed vertically downwards to a rotating distributor which throws out the heat softened material onto the walls of a downwardly facing annular cup The cup forms part of a rotor which rotates at high speed and therefore gravity and centrifugal force causes the material to flow downwards along the inner walls of the cup and then out from the bottom rim of the cup. This projects the material outwardly in the form of a film and this film is then broken up into flakes. It is suggested that the film can be broken up into flakes by mechanical means and the specification also described a method of breaking the film into flakes by blowing gas at high pressure in a direction so that it cuts through the film to break it up into flakes. This method and apparatus has now been used for a number of years but it involved complex arrangements of heating and cooling means about the rotor and its surrounds. Moreover the glass flakes produced are often inconsistent in size and thickness.

US-A-3607165 discloses apparatus for forming glass fibres which includes a cup-shaped spinner body mounted for rotation about a vertical axis with the open end of the body facing upwardly. The spinner rim is serrated to divide glass into separate streams and glass fibres are blown downwardly into a numeratic conveyer for collection and removal.

Summary of the Invention

According to the invention there is provided apparatus for forming flakes of material from a heated stream of molten material comprising means for feeding the stream in a downwards direction into a rotating cup, the cup being arranged such that its opened mouth faces upwardly such that molten material within the cup is caused to flow over the upper edges of the cup and flow outwards in a radial direction due to centrifugal force, the apparatus also including a pair of spaced apart substantially parallel plates arranged about the cup such that the material leaving the cup by centrifugal force passes through a gap defined between the plates, the plates being mounted within a vaccum chamber arranged such that a vaccum is applied to the space between the plates to draw air from outside the chamber between the plates in a radial direction to prevent the molten material from touching the sides of the plates and to cool material until it reaches a solid state pulling the material in a radial direction, thereby keeping the material in a flat film and breaking it into small platelets.

Preferably, the vacuum chamber is a cyclone vacuum chamber.

Thus the molten material fed between the plate is prevented from rolling or rucking over.

Preferably the plates are in the form of two annular plates with the cup mounted such that its rim lies between the plates.

Preferably the vacuum chamber is connected via its outlet to a cyclone precipitator/separator and vacuum pump.

By suitable choices of the speed of rotation of the cup, the distance between the two plates and the rate of air flow through the vacuum chamber, the size and thickness of the flakes of material to be produced can be controlled.

Preferably the cup has tapered sides so that its top edge flares outwards so that the passage of the molten material up the sides of the cup is aided by centrifugal force.

The apparatus can be used to produce flakes of many different materials which can be molten Typically this material will be glass but the apparatus may equally be used with materials such as basalt, ceramics such as alumina, graphite, and metals such as lead.

For each different material, it may be necessary to alter the operation of the apparatus by, for instance, varying the speed of rotation of cup, the temperature of the molten material, the size of the molten material gap between the plates and the airflow between the plates. It is preferred therefore that the apparatus includes means to vary as many of these parameters as possible.

It is therefore preferred that the cup is attached to a variable speed electric motor which allows the speed of rotation to be varied readily.

Preferably at least one of the plates is mounted so that it can be moved towards or away from the

other. Clearly by varying the distance between the plates this will also have an effect on the speed of airflow between them.

The speed of airflow can also be varied by varying the vacuum pull applied to the cyclone vacuum chamber.

The produced flakes can be treated by coating with suitable bonding agents or other chemicals by injecting an adhesion promotor or chemical either as the material leaves the cup or as it leaves the gap between the two plates.

It should be noted that the diameter of the plates will also have an effect on the flake size and thickness to be produced and this also will have to be carefully chosen.

The variable parameters can be varied within wide ranges and all have an inter-relation on each other The material to be used is chosen. It will be readily apparent to the skilled addressee of the specification on how to vary the parameters to produce flakes of required size and thickness.

Once the parameters for a particular material type and flake size are established the apparatus will produce that material constantly within very fine dimensional limits.

The present invention also provides a method of forming flakes which comprises feeding a stream of molten material in a downwards direction into a rotating cup; and allowing the material to pass over the edge of the cup in such manner as to be forced into the gap between a pair of plates surrounding the cup, such movement of the material being in a radial direction and effected by a flow of air passing between the plates so as to pull the stream of material in a radial direction in such manner as to keep it flat and also to pull it so that, as solidification of the material is effected, the material is broken into flakes.

Brief Description of the Drawing

A method and apparatus for forming flakes of material from a stream of molten material will now be described by way of example only with reference to the accompanying drawing which is a schematic section through the apparatus.

Description of the Preferred Embodiment

Apparatus 1 for manufacturing flaked material from a stream of molten material consists of a variable speed electric motor 3 mounted vertically to which is attached a tapered cup 5.

The rim of the cup 7 lies between two annular plates 9, 11, the upper one 9 of which is adjustable. The two plates 9, 11 are mounted within a cyclone vacuum chamber 13 which is connected via the outlet connection 15 to a cyclone precipitator, separator and vacuum pump (not shown).

The method of operation is as follows. The cup 5 is rotated at speed and the stream 17 in this case of glass, is allowed to enter from above. Centrifugal force distributes the glass evenly within the cup and pushes the glass outwards over the cup rim 7.

The vacuum is applied to the cyclone vacuum chamber 13 via the outlet connection 15. Air enters this chamber via the gap 19 between the annular extraction plates 9 and 11 at a point 21 on the lower plate 11 and a corresponding location on the upper plate 9

The entering air has a dual effect on the process.

The air flow continues to cool the glass until it reaches a solid state, and due to friction upon the glass, continues to pull in a radial direction, thus preventing the glass from rolling or rucking over, keeping the glass flat and breaking it into small platelets.

The platelets are collected in the cyclone vacuum chamber 13 and exit via connection 15 to a precipitator cyclone and filter section (not shown).

The size (loosely described as the diameter of platelet or flake) and the thickness of flake can be varied through a considerable range by adjusting the flow of glass into the cup 5, adjusting the speed of rotation of the cup 5, adjusting the distance between the annular extraction plates 9 and 11 and varying the vacuum pull or velocity through the gap 19 between the annular extraction plates for any given gap by varying the amount of air flow through the extraction connection 15. Thus, a range of materials can be manufactured on this equipment both in diameter and thickness without recourse to further grading, crushing or grinding operations.

The product produced is taken through the stages of manufacturing to packaging without being exposed to the atmosphere external to the equipment.

Treatment of the flakes produced by coating with suitable bonding agents or other chemicals, can easily be made by injecting such adhesion promotor or chemical at point 23, or other suitable location such as point 21 within the air flow.

A glass stream of low temperature can be extruded by the air flow through the gap 19 with considerable force, pulling it extremely thin even at low temperature. Alternately the gap 19 can be increased and the speed of the centrifuge cup 5 increased to give different parameters for the production of flake.

Because the variables are wide, e.g. the volume of molten stream entering centrifuge cup 5, the temperature of that material, the speed of centrifuge cup 5 , the diameter of centrifuge cup 5, the

gap at 19, the distance between 7 and 23, and the air flow at 15, the process lends itself to manufacture of flake of various sizes from many different materials with varying viscosities and melting points.

Once the parameters for a particular material type and flake size are established, the apparatus will produce that material constantly within very fine dimensional limits.

Claims

1. Apparatus (1) for forming flakes of material from a heated stream (17) of molten material, said apparatus comprising means for feeding the stream in a downwards direction into a rotating cup (5), the cup being arranged such that its open mouth faces upwardly whereby molten material within the cup is caused to flow over the upper edges (7) of the cup and flow outwards in a radial direction due to centrifugal force, the apparatus also including a pair of spaced apart substantially parallel plates (9, 11) arranged about the cup such that the material leaving the cup by centrifugal force passes through a gap (19) defined between the plates, the plates being mounted within a vacuum chamber (13) so arranged that a vacuum is applied to the gap between the plates to draw air from outside the chamber between the plates in a radial direction to prevent the molten material from touching the sides of the plates and to cool the material until it reaches a solid state pulling the material in a radial direction thereby keeping the material in the form of a flat film and breaking it into small platelets.

2. Apparatus (1) according to Claim 1, characterised in that the vacuum chamber (13) is a cyclone vacuum chamber.

3. Apparatus (1) according to Claim 1, characterised in that the plates (9, 11) are two annular plates and the cup (5) is mounted so that its rim (7) lies between the two plates

4. Apparatus (1) according to Claim 2, characterised in that the vacuum chamber (13) is connected via its outlet (15) to a cyclone precipitator/separator and a vacuum pump.

5. Apparatus (1) according to Claim 1, characterised in that the cup (5) has tapered sides and its top edge (7) flares outwardly.

6. Apparatus (1) according to Claim 1, characterised in that rotation of the cup (5) is effected by a variable speed electric motor (3).

7. Apparatus (1) according to Claim 1, characterised in that at least one of the plates (9, 11) is so mounted that it can be moved towards and away from the other plate.

8. A method of forming flakes which comprises feeding a stream (17) of molten material in a downwards direction into a rotating cup (5); and allowing the material to pass over the edge (7) of the cup in such manner as to be forced into the gap (19) between a pair of plates (9, 11) surrounding the cup, such movement of the material being in a radial direction and effected by a flow of air passing between the plates so as to pull the stream of material in a radial direction in such manner as to keep it flat and also to pull it so that, as solidification of the material is effected, the material is broken into flakes.

9. A method of producing flakes according to Claim 8, characterised in that the flakes are treated by coating with an additive either as the material leaves the cup (5) or as it leaves the gap (19) between the two plates (9, 11).

Revendications

1. Dispositif (1) pour former des paillettes de matériau à partir d'un flux chauffé (17) de matériau fondu, ledit dispositif comprenant un moyen pour délivrer le flux vers le bas dans une cuvette tournante (5), la cuvette étant disposée d'une manière telle que son embouchure s'ouvre vers le haut si bien que le matériau fondu à l'intérieur de la cuvette est amené à s'écouler au-dessus des bords supérieurs (7) de la cuvette et à s'écouler vers l'extérieur dans un sens radial dû à la force centrifuge, le dispositif comportant également une paire de plaques séparées pratiquement parallèles (9, 11) disposées autour de la cuvette d'une manière telle que le matériau quittant la cuvette par la force centrifuge passe par un intervalle (19) défini entre les plaques, les plaques étant montées à l'intérieur d'une enceinte à vide (13) disposée d'une manière telle qu'une dépression est appliquée à l'intervalle entre les plaques pour aspirer de l'air de l'extérieur de la chambre entre les plaques dans un sens radial afin d'empêcher que le matériau fondu touche les côtés des plaques et pour refroidir le matériau jusqu'à ce qu'il atteigne un état solide en tirant le matériau dans un sens radial conservant, de ce fait le matériau sous la forme d'un film plat et le rompant en de petites

plaquelettes.

2. Dispositif (1) selon la revendication 1, caractérisé en ce que l'enceinte à vide (13) est une enceinte à vide cyclone.

3. Dispositif (1) selon la revendication 1, caractérisé en ce que les plaques (9, 11) sont deux plaques annulaires et en ce que la cuvette (5) est montée d'une manière telle que son rebord (7) se trouve entre les deux plaques.

4. Dispositif (1) selon la revendication 2, caractérisé en ce que l'enceinte à vide (13) est en communication par l'intermédiaire de sa sortie (15) avec un séparateur/précipitateur cyclone et une pompe à vide.

5. Dispositif (1) selon la revendication 1, caractérisé en ce que la cuvette (5) comporte des côtés coniques et son bord supérieur s'évase vers l'extérieur.

6. Dispositif (1) selon la revendication 1, caractérisé en ce que la rotation de la cuvette (5) est effectuée par un moteur électrique à vitesse variable (3)

7. Dispositif (1) selon la revendication 1, caractérisé en ce qu'au moins une des plaques (9, 11) est montée d'une manière telle qu'elle peut se déplacer vers et loin de l'autre plaque.

8. Procédé pour former des paillettes qui comprend la fourniture d'un flux (17) de matériau fondu dans un sens vers le bas dans une cuvette tournante (5) et permettant au matériau de passer au-dessus du bord (7) de la cuvette d'une manière telle qu'il soit forcé dans l'intervalle (19) entre une paire de plaques (9, 11) entourant la cuvette, un tel déplacement du matériau étant dans un sens radial et effectué par un écoulement d'air passant entre les plaques de façon à tirer le flux de matériau dans un sens radial d'une manière telle à le conserver plat et également à le tirer d'une manière telle que, lorsque la solidification du matériau est effectuée, le matériau est rompu en paillettes.

9. Procédé pour produire des paillettes selon la revendication 8, caractérisé en ce que les paillettes sont traités par revêtement avec un additif, soit lorsque le matériau quitte la cuvette (5), soit lorsqu'il quitte l'intervalle (19) entre les deux plaques (9, 11).

Patentansprüche

1. Vorrichtung (1) zur Bildung von schuppenförmigem Material aus einem erhitzten Strom (17) von geschmolzenem Material, die Vorrichtungen zur Einspeisung des Stroms in Abwärtsrichtung in eine rotierende Schale (5) aufweist, wobei die Schale so angebracht ist, daß ihre Öffnung nach oben weist und wobei ein Fluß des geschmolzenen Materials innerhalb der Schale über die oberen Ränder (7) der Schale und nach außen in einer radialen Richtung in Folge von Zentrifugalkraft verursacht wird, wobei die Vorrichtung auch ein Paar von in Abstand voneinander angebrachten, im wesentlichen parallelen Platten (9, 11) aufweist, die um die Schale herum in der Weise angebracht sind, daß das die Schale durch Zentrifugalkraft verlassende Material durch eine zwischen den Platten gebildete Lücke (19) fließt, wobei die Platten innerhalb einer Vakuumkammer (13) so angebracht sind, daß ein Vakuum auf die Lükke zwischen den Platten angelegt wird, so daß Luft von außerhalb der Kammer zwischen die Platten in radialer Richtung angezogen wird, die verhindert, daß das geschmolzene Material die Seiten der Platten berührt und das Material kühlt bis es einen festen Zustand erreicht, indem sie das Material in radialer Richtung treibt, wobei sie das Material in Form eines dünnen Films hält und es in kleine Plättchen bricht.

2. Vorrichtung (1) nach Anspruch 1, dadurch gekennzeichnet, daß die Vakuumkammer (13) eine Zyklon-Vakuumkammer ist.

3. Vorrichtung (1) nach Anspruch 1, dadurch gekennzeichnet, daß die Platten (9, 11) zwei ringförmige Platten sind und die Schale (5) so befestigt ist, daß ihr Rand (7) zwischen den beiden Platten liegt.

4. Vorrichtung (1) nach Anspruch 2, dadurch gekennzeichnet, daß die Vakuumkammer (13) durch ihren Ausgang (15) mit einem Zyklonabscheider/-separator und einer Vakuumpumpe verbunden ist.

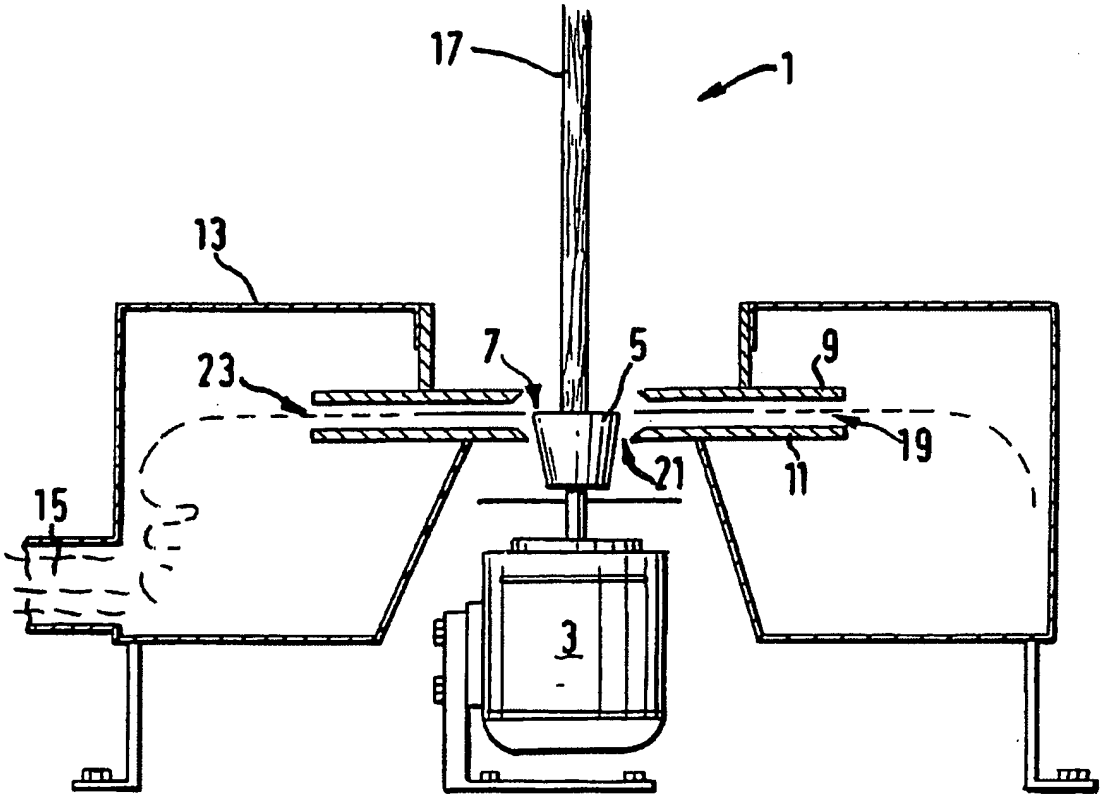
5. Vorrichtung (1) nach Anspruch 1, dadurch gekennzeichnet, daß die Schale (5) sich verjüngende Seiten hat und ihre obere Kante nach außen erweitert ist.

6. Vorrichtung (1) nach Anspruch 1, dadurch gekennzeichnet, daß die Rotation der Schale (5) durch einen Elektromotor (3) mit variabler Geschwindigkeit bewirkt wird.

7. Vorrichtung (1) nach Anspruch 1, dadurch gekennzeichnet, daß wenigstens eine der Platten (9, 11) so befestigt ist, daß sie zur anderen Platte hin und davon weg bewegt werden kann.

8. Verfahren zur Herstellung von Schuppen, daß folgende Schritte umfaßt:
Einspeisung eines Stroms (17) von geschmolzenem Material in Abwärtsrichtung in eine rotierende Schale (5),
Fließenlassen des Materials über die Kante (7) der Schale in der Weise, daß es in eine Lücke (19) zwischen einem Plattenpaar (9, 11) gedrängt wird, das die Schale umgibt, wobei die Bewegung des Materials in einer radialen Richtung erfolgt und durch einen Luftstrom zwischen den Platten bewirkt wird, so daß der Radialstrom in radialer Richtung so gedrückt wird, daß er flach bleibt und das Material, wenn Verfestigung eintritt, in Schuppen gebrochen wird

9. Verfahren zur Herstellung von Schuppen nach Anspruch 8, dadurch gekennzeichnet, daß die Schuppen durch Beschichtung mit einem Additiv behandelt werden, entweder wenn das Material die Schale (5) verläßt oder wenn es die Lücke (19) zwischen den beiden Platten (9, 11) verläßt.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